REPRODUCtIVE REVOLUTION

What if scientists could figure out a way to slow down or turn back the biological clock, so that women could prolong their fertility?

In recent years, a growing number of researchers have begun to pose that question. One key discovery was made in 2016 by Francesca Duncan, a professor of reproductive science, and her team at Northwestern University. They noticed that the ovary becomes stiffer, or “fibrotic,” over time. “The ovary’s very dynamic,” Duncan said. “There’s a lot going on, including the growth of follicles (the structures that contain and nurture immature eggs, or oocytes), the rupture of a follicle to release an egg with ovulation, and the death and reabsorption of unreleased oocytes.”

All of this activity means that tissue is constantly getting repaired, which can lead to fibrosis—essentially, scarring. Duncan and other scientists, including Rohrer, have been investigating possible therapies that could “soften” the ovary and extend fertility. A 2022 paper in Science Advances, co-authored by Rohrer, reported that existing antifibrosis drugs restored ovulation in 15-month-old mice, comparable to humans around age 50. Duncan and other scientists, including Robker, have been investigating possible therapies that could “soften” the ovary and extend fertility.

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Illuminating the Human Embryo

As a female ages, eggs and the embryos that develop from them run a greater risk of genetic abnormality. This can lead to infertility or miscarriage, risks that increase significantly after the age of 35. Recently, using fluorescent dyes and laser microscopes, researchers have captured the most detailed images ever seen of human embryos growing in a lab. This breakthrough imaging technique could help doctors improve embryo selection during the in vitro fertilization (IVF) process, leading to higher pregnancy and lower miscarriage rates.

1. **The number of eggs females have is set at birth—and is depleted later in life.** Eggs are produced in a finite number of follicles that develop when the female is still a fetus. Some fetuses have more than a million follicles, all formed in the first months of fetal development. Once the menstrual cycle begins, follicles become eggs. As a female ages, her potential number of eggs is gradually depleted through ovulation and cell death. On average, there are about a hundred thousand follicles at the start of puberty and a thousand at menopause.

2. **Fertilization** The tens of millions of sperm released during ejaculation swim through the uterus to the fallopian tubes, where fertilization and the first stages of embryonic development occur. The DNA from a sperm and the egg combine to form the genome of the fertilized egg.

3. **Cell division** The fertilized egg, called a zygote, continues to move through the fallopian tube. After about 20 hours, it splits into two cells, then four, and so on, continually dividing roughly every 12 hours.DNA in the nucleus of the cells (pictured in blue) is copied and divided equally.

4. **Blastocyst formation** The cells of the developing embryo continue to divide, forming a fluid-filled structure called a blastocyst about five to six days after fertilization. The blastocyst contains 100 to 200 cells, organized to become either the future fetus or the future placenta.

5. **Hatching** One to three days after a blastocyst enters the uterus, it begins to hatch, shedding its outer layer so it can implant in the uterine wall. The inner blastocyst cells become the fetus; the outer cells become the placenta. (During IVF, this is typically when an embryo is transferred to a patient’s uterus.)